

Highlights of the First Time of Transition: 1945–51

The National Science Foundation Act of 1950,¹ which President Truman signed into law on May 10 of that year, gave NSF the mandate “to promote the progress of science; to advance the national health, prosperity, and welfare; and for other purposes.” The breadth of this mandate indicates that a bipartisan majority existed in Congress about the significance of science and engineering in addressing matters of national importance. NSF’s creation occurred near the end of the time of transition in which the basis of U.S. science policy was established and many of the principal issues and concerns comprised by that policy were articulated. But the concept of a National Science Foundation had emerged several years earlier. (See text table 1-1.)

Emergence of a Concept

More than a year before World War II ended on September 2, 1945, a few members of Congress and a handful of officials in the Roosevelt Administration had foreseen the essential roles that science and engineering would play dur-

ing peacetime. Early in 1944, Senator Harley M. Kilgore (D-WV), a member of a Select Committee chaired by Senator Harry S Truman (D-MO) investigating the war production effort, introduced a bill to create a National Science Foundation (Kevles 1977). While Kilgore’s National Science Foundation would have given priority to Federal Government laboratories in the disposition of funds, it would also have been authorized to award research contracts and scholarships to colleges and universities. Kilgore’s colleagues in the Senate convinced him that hearings on his proposed bill should be postponed until after the end of the war.

In November 1944, President Franklin D. Roosevelt addressed a letter to Vannevar Bush, his *de facto* science advisor, asking for his advice on how the lessons learned from the World War II organization of science and engineering could be applied in peacetime. Bush’s response came seven months later in July 1945, when he delivered the requested report, *Science—The Endless Frontier*, to President Truman (Bush 1945a). By the end of that month, Senator Warren Magnuson (D-WA) had introduced legislation to implement the centerpiece recommendation of what is commonly referred to as the Bush report: namely, to establish a National Research Foundation to provide Federal funds for research to nonprofit institutions outside of the Federal Government (including

Text table 1-1.
Highlights of the first transition

Year	Month	Science policy events	Other events
1944	February November	Kilgore legislation introduced in Senate Roosevelt’s letter to Bush	Roosevelt reelected
1945	April May July September October	<i>Science—The Endless Frontier</i> Senate hearings on NSF began	Death of Roosevelt End of World War II in Europe End of World War II in the Pacific
1946	August October	AEC and ONR created Steelman board established	
1947	June August	<i>Science and Public Policy</i>	Marshall Plan announced
1948	February September November	Truman speech at AAAS meeting	First electronic computer Truman reelected
1950	May June December	NSF created Truman addressed first NSB meeting	Korean War began United Nations forces abandon Pyongyang and Seoul
1951	April July	First NSF director sworn in; SAC/ODM established NSF Annual Report, with R&D expenditure data included	Gen. MacArthur relieved of command of United Nations troops in Korea

civilian defense research and medical research) and to award scholarships and fellowships to aspiring scientists and engineers. Within a few days, Senator Kilgore reintroduced a revised version of his earlier bill.

The Kilgore and Magnuson bills differed both in the types of institution given priority for research support and in their proposed administrative structure. Deep-seated disagreements on the latter issue persisted and delayed the creation of NSF for almost five years. Between 1945 and 1950, a vigorous public debate took place on the institutional framework for science. That debate, which included the nature of a National Science Foundation, took five years to resolve; during this period, both the Office of Naval Research (ONR) and the National Institutes of Health (NIH) were created, reducing the scope of the proposed foundation.²

Congressional Initiatives

Joint hearings on the Magnuson and Kilgore bills, which began in October 1945, were among the first in a series of congressional debates and administration actions whose outcomes determined the character of Federal Government support for, and involvement with, science and technology that has largely persisted for the past half-century. Congress, for the first time, began to deal with significant science- and technology-related issues on a more or less continual basis. Its extensive, open-to-the-public committee hearings called heavily on members of the public and the scientific community as it sought to forge new policies and create a new organizational framework for Federal Government science.

The most controversial issue addressed by Congress during the immediate postwar years had to do with whether the control of nuclear energy should remain with the military or be consigned to civilian hands (Smith 1965). On August 1, 1946, following extensive and frequently impassioned hearings that involved many of the younger scientists who had been engaged in the ultra-secret World War II work to produce nuclear weapons, Congress established the Atomic Energy Commission (AEC), to be governed by a five-member commission of presidentially appointed civilians.³

On August 1, 1946, Congress also created the ONR.⁴ Both AEC and ONR soon began to support university research in fields broadly related to their respective missions. Two years later, NIH within the Public Health Service began to follow suit by supporting research through contracts to the Nation's medical schools. Prior to that time, the agency's research program had focused on specific health-related problems and was carried out largely intramurally. Thus by the time NSF was created in May 1950, several Federal mission agencies had already gained considerable experience in funding university research.

²See England (1983, 25–110).

³An Act for the Development and Control of Atomic Energy, Public Law 585, 79th Congress, 2nd Session.

⁴An Act to Establish an Office of Naval Research in the Department of the Navy, Public Law 588, 79th Congress, 2nd Session. The Secretary of the Navy had used his emergency authority to create ONR on a temporary, interim basis in May 1945.

Administration Actions

On October 17, 1946, in response to the rapid expansion in the Federal Government's organization for science, President Truman established the President's Scientific Research Board (PSRB) chaired by John R. Steelman, who became The Assistant to the President on January 1, 1947. The first of five volumes of PSRB's report, entitled *Science and Public Policy* and commonly referred to as the Steelman report (Steelman 1947), was released on August 27, 1947. This report analyzed, and made recommendations about, the entire Federal science and technology system; the relations between research in the Federal Government, industrial, and academic sectors; and the condition of science teaching at all levels, from the primary grades through graduate school. It based its analysis of the state of the Nation's science and technology enterprise on extensive sets of data and several specially commissioned studies.

The President drew on the Steelman report to propose a national science policy in his September 1948 address to AAAS (Truman 1948). One element of his proposed policy—to create a National Science Foundation—was fulfilled when Congress passed the National Science Foundation Act of 1950.⁵

The Act that Truman signed into law in May 1950 defined NSF as “an independent agency ... [to] consist of a National Science Board and a Director.”⁶ Accordingly, the Foundation was officially activated when the Board convened for the first time on December 12, 1950, in the White House (England 1983, 123). President Truman joined the first NSB meeting and addressed the Board. Thereafter, the chairman reported to the President on actions taken by the Board during the morning session. Those actions consisted of the election of the chairman (James B. Conant) and vice chairman (Edwin B. Fred), establishment of a committee to recommend to the President names of people who might be appointed to the position of director of NSF, and establishment of an executive committee.

Impacts of the Korean War

President Truman had a great deal on his mind at the time he addressed the NSB's first meeting. A month earlier, the People's Republic of China had intervened in the Korean War.⁷

⁵Several long-forgotten controversies delayed the Congress's passage of this Act, perhaps because the value of basic research was not sufficiently understood a half-century ago. These controversies were resolved through the patient work of several key individuals. William D. Carey in the Bureau of the Budget (BoB) continued to insist to his colleagues that the creation of a National Science Foundation was critical to the long-term interests of the Nation. Elmer Staats, his direct supervisor, and Willis Shapley, his BoB colleague, aided him in his crusade.

No doubt the single individual, in addition to Carey, who deserves credit for negotiating the compromise between the scientific community and the Truman Administration and Congress for the creation of a National Science Foundation was Dael Wolfe, at that time executive secretary of the American Psychological Association and also secretary of the AAAS-based Intersociety Committee for a National Science Foundation.

⁶Public Law 81-507, Section 2.

⁷The Korean War began on June 25, 1950 (six weeks after NSF was created), when North Korean troops crossed the 38th parallel into South Korea and within two days captured Seoul.

On the day Truman met with the Board, United Nations' forces abandoned the North Korean capital of Pyongyang, which they had captured in September 1950, and within a few days abandoned Seoul, the South Korean capital, as well. There was justifiable concern that it might not be possible to confine the worsening military situation to Korea. By that time, the White House had already commissioned William T. Golden, a New York investment banker, to prepare a report on how the Nation's scientific resources might be mobilized to address any wider military emergency (Blanpied 1995, xiv–xliv). Whether or not such a wider emergency would occur, it was abundantly clear that both the Congress and the Administration would thenceforth accord a high priority to defense-related research and development (R&D).

Despite the Korean emergency, the NSB adopted a long-term view as it proceeded to work out the policy implications of NSF's charter and develop plans to implement its programmatic mission. At the conclusion of its third meeting on February 13–14, 1951, the Board issued a public statement that disavowed any direct NSF involvement with defense-related research, while reemphasizing that “the fundamental objective of the National Science Foundation is the promotion of basic research and education in the sciences throughout the country.”⁸

On December 18, 1950, less than a week after the first meeting of the NSB, Golden addressed a memorandum to the President recommending that he appoint a full-time science advisor to assist in mobilizing science for defense purposes and, additionally, provide high-level oversight of the entire Federal science organization. President Truman accepted the essence of this recommendation when, on April 19, 1951, he established the Scientific Advisory Committee to the White House Office of Defense Mobilization (SAC/ODM), a body that was destined to evolve into a full-scale presidential scientific advisory system.⁹

With the creation of SAC/ODM, all principal elements of the U.S. Government's science structure were in place, including a protopresidential advisory and coordination system¹⁰ and the six agencies—or their predecessors—that have long accounted for more than 90 percent of Federal R&D expenditures.¹¹ Most changes made in that structure during the next 50 years were designed to adapt it to the evolving

political, economic, and social environment in which the U.S. science and technology enterprise functions and to the spectacular growth of the enterprise itself.

One important refinement in the Federal Government's organization for science and technology was the creation of the Defense Science Board (DSB), which was chartered to “canvass periodically the needs and opportunities presented by new scientific knowledge for radically new weapons systems.” Initially, DSB, which met for the first time on September 20, 1956, was an advisory body to the Assistant Secretary of Defense (Research and Development). During the next few years, as the Defense Department was reorganized to reflect the increasing importance of science and technology to its mission, the status of DSB was elevated to that of an advisory body to the Secretary of Defense. DSB currently consists of 32 members who are appointed for terms ranging from one to four years and selected on the basis of their preeminence in the fields of science and technology and their applications to military operations, research, engineering, manufacturing, and acquisition processes. It also includes the chairs of seven advisory bodies to other Defense Department organizations as *ex officio* members.

Investments

From the outset, the NSB assumed responsibility to gather, analyze, and disseminate quantitative information on the condition of the U.S. science and engineering enterprise. The first *National Science Foundation Annual Report*, covering fiscal year (FY) 1951 (July 1, 1950, to June 30, 1951) and issued under the guidance of the Board, included data estimates from the Department of Defense Research and Development Board on R&D expenditures by the Federal Government and “other” sources, from 1940 through 1952, in addition to data on R&D performance by the industrial, Federal Government, and academic sectors over the same period. It also reproduced more detailed data from the Bureau of the Budget (BoB) on R&D expenditures by the principal Federal agencies from 1940 to 1950.¹² NSF was not represented in the latter tabulation, since it had been created only during the final months of FY 1950, with a budget of \$225,000 to defray administrative startup costs during its first year.

The Foundation's second annual report, covering the period from July 1, 1951, to June 30, 1952, extended the data on Federal R&D expenditures through FY 1952. (See text table 1-2.) NSF was included for the first time, Congress having appropriated an estimated \$1.1 million for R&D expenditures from a total FY 1952 appropriation for NSF of \$3.5 million.¹³ NSF's

⁸References to National Science Board actions during its first meetings are taken from the unpublished minutes of those meetings.

⁹From a letter written by Harry S. Truman, dated April 19, 1951, to Oliver E. Buckley; see Blanpied (1995, 72–4).

¹⁰On November 7, 1957, a month after the Soviet Union launched Sputnik I, President Dwight D. Eisenhower created a full-scale Presidential Advisory System when he elevated SAC/ODM into the President's Science Advisory Committee and named James R. Killian, Jr., president of the Massachusetts Institute of Technology, as his full-time science advisor; see “The Precarious Life of Science in the White House,” by David Z. Beckler (Holton and Blanpied 1976, 118).

¹¹Four of these agencies still exist in their 1951 form: the Department of Defense, NIH (now within the Department of Health and Human Services), NSF, and the U.S. Department of Agriculture. In 1958, as one response to the launching of Sputnik I by the Soviet Union in October 1957, the scope of the National Advisory Committee for Aeronautics, created in 1915, was expanded and the agency renamed the National Aeronautics and Space Administration. AEC was subsumed into the Energy Research and Development Agency in 1975, which in turn was absorbed into the Department of Energy when the latter department was created in 1977.

¹²Prior to 1976, the U.S. Government fiscal year began on July 1 of the succeeding calendar year, rather than on October 1 as it does at present.

¹³In 1945, *Science—The Endless Frontier* (Bush 1945a, 40) had recommended a budget of \$33.5 million for the Foundation's first year, which would have been approximately \$47.1 million in 1951 constant dollars. However, the National Science Foundation Act of 1950 included an amendment limiting the agency's appropriation to \$15 million per year, or approximately \$95 million in constant 1999 dollars. NSB had requested \$13.5 million for NSF for FY 1952; Congress reduced it to \$3.5 million (\$20 million in 1999 constant dollars) on the grounds that the imperatives of the Korean War precluded anything more. The \$15 million limitation was removed in 1953.

Text table 1-2.

Federal R&D appropriations for Fiscal Year 1952

Agency	Amount of U.S. dollars (in millions)		Percent	
	1952 current	1998 constant	Total	Non-DOD
Department of Defense (DOD)	890.0	5,071.6	70.6	
Non-DOD	370.2	2,109.5	29.4	100.0
Atomic Energy Commission	162.9	928.3	12.9	44.0
Public Health Administration ^a	38.5	219.4	3.1	10.4
National Advisory Committee for Aeronautics	49.4	281.5	3.9	13.3
National Science Foundation	1.1	6.3	0.1	0.3
Agriculture Department	51.7	294.6	4.1	14.0
Commerce Department	15.4	87.8	1.2	4.2
Interior Department	31.9	181.8	2.5	8.6
Other	19.3	110.0	1.5	5.2
Total	1,260.2	7,181.1	100.0	

NOTE: Details may not sum to totals because of rounding.

^aIncludes National Institutes of Health.SOURCE: National Science Foundation, *Second Annual Report* (Washington, DC: U.S. Government Printing Office, 1952).

Science & Engineering Indicators – 2000

total budget for that year also included \$1.53 million for graduate and post-doctoral fellowships. The remaining funds were allocated for administration, and for miscellaneous activities, including scientific translations.

Despite the fact that its R&D appropriation for FY 1952 was \$1.1 million, compared with the total Federal R&D budget of more than \$1.2 billion, NSF already occupied a unique position in the Federal system. It was—and remains—the sole agency chartered to support research and education across all fields of science and engineering. In addition, Congress expected NSB, its policymaking body, to deal with issues transcending the Foundation's programmatic mission. Among other things, NSF (by law the National Science Board and Director) was “authorized and directed” to develop and encourage the pursuit of a national policy for the promotion of basic research and education in the sciences; ... to foster the interchange of scientific information among scientists in the United States and foreign countries; and ... to correlate the Foundation's scientific research programs with those undertaken by individuals and by public and private research groups.”¹⁴

The evolution of the Board's involvement in monitoring the state of science and engineering, culminating with the transmission of the first *Indicators* report (NSB 1973) to President Richard M. Nixon in 1973, is discussed in “Monitoring the Condition of the Science and Engineering Enterprise.”

Early Visions/Key Policy Documents

Both the size and complexity of the U.S. science and engineering enterprise have grown substantially since the creation of NSF. Despite this, a striking continuity with the present is discernible in the visions of science–government relations that

emerged in the immediate aftermath of World War II. These early visions were encapsulated in two key policy documents: *Science—The Endless Frontier* (July 1945) and *Science and Public Policy* (August 1947). Although differing in many respects, both reports emphasized the need for a strong commitment to genuine partnerships and linkages among the industrial, academic, and Federal Government research sectors, a commitment that is among the unique strengths of the U.S. system.

Science—The Endless Frontier (1944–45)

The impetus for *Science—The Endless Frontier*, as already noted, was a letter addressed to Vannevar Bush by President Franklin D. Roosevelt on November 17, 1944, 10 days after President Roosevelt's reelection to an unprecedented fourth term. The President's letter asked for advice on how lessons learned from the mobilization of science and engineering during World War II might be used in peacetime “for the improvement of the national health, the creation of new enterprises bringing new jobs, and the betterment of the national standard of living” (Bush 1945a, 3).

Creation of the Office of Scientific Research and Development

That the President would seek guidance on these matters from Vannevar Bush, who was director of the wartime Office of Scientific Research and Development (OSRD) was natural enough, since Bush had been serving as his *de facto* science advisor for more than a year before the United States entered World War II in December 1941. On June 12, 1940, seven days after the German army invaded France, Bush, president of the Carnegie Institution of Washington and a former Dean of Engineering at the Massachusetts Institute of Technology (MIT), met with the President to propose that he should

¹⁴Public Law 81-507, Section 3(a).